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DESCRIPTION

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IMPROVED TRIPOD LADDER

TECHNICAL FIELD

10 This invention relates to the field of folding ladders, especially to stepladders, and stepladders of a triangular or tripod aspect.

BACKGROUND ART

15 Step Ladders provide a means for an individual to climb to a height for manipulating objects or performing work in locations where the ladder must be free standing, not resting against a support. The ladder depends solely upon its construction and erection to insure its stability, in contrast to extension ladders which are braced against a structure in use.

20 A typical step ladder is designed to be folded into a convenient size for storage and carrying, and the requirement that it be portable is a major design constraint, restricting the weight of the ladder. Thus a typical step ladder will be found to weigh thirty pounds
25 (approximately 15 kilograms) or less in weight, in order to ensure that it may be easily handled. It is also designed to be folded into a package that, insofar as possible, is not of significantly increased size over a folded ladder of similar height reaching capability.

30 The stability of step ladders is dependent upon the user's movement on the ladder during use. The requirement that the ladder be portable tends to reduce

the weight to the minimum consistent with required structural strength. Considering that an average user will weigh about One Hundred Fifty pounds (about sixty
5 eight kilograms), in use practically all the weight involved in the dynamic couple of ladder and user will be concentrated in the user, and there will be very little static weight tending to stabilize the ladder.

10 Thus the location of the user's weight (the user's center of gravity) determines the static stability of the ladder in use; if a vertical line down from the user's center of gravity falls out of the footprint of the ladder, then the ladder will topple.

15 Motion of the user on the ladder will further couple to the ladder, creating a tendency of the ladder to walk over the surface. Such walking is indicative of one leg of the ladder being unloaded, and shows marginal stability in the ladder.

20 Since tripods are known to be stable structures, especially on unstable ground, various attempts have been made to create ladders of triangular structure, with three independent legs. As an example, Harrison, US Patent 2,650,014 discloses such a structure. However,
25 the independently articulated legs lack the bracing of the legs in an "A" frame ladder, and the resulting ladder is unsatisfactory as the legs lack rigidity for adequate dynamic stability.

30 A similar prior structure is shown in the inventor's prior published US Patent 4,754,845.

However, prior attempts to make the structure of the legs in a tripod ladder sufficiently well braced for dynamic stability have resulted in bracing and extension

schemes which bind during opening and thus make the ladder difficult to use.

DISCLOSURE OF INVENTION

5 The invention shows an improved form of tripod ladder having a coordinated, folding extension and collapsing mechanism which substantially avoids binding and yet provides extremely rigid construction especially for the individual rear legs which are otherwise susceptible to
10 bending.

 The invention comprises in a tripod ladder, an improved erection and support mechanism based on a vertically extending, triangular cross section center post, fastened at an upper end to the upper platform of
15 the ladder, defining a central axis about which the ladder vertically extends. This center post acts as a vertical guide or tracking device at the vertex of the planes of extension of each of the major support legs. A sliding collar of improved design slides along the
20 center post to both control and coordinate the movement of these extending parts. Single, tension, compression and torsion resistant braces are pivotally affixed at one end to the sliding collar and at the other end to a leg assembly. Collar movement along the center post
25 thus controls the opening of the ladder, coordinating the opening motion in that all legs extend and contract uniformly together. The triangular center post defines angles of extension. Alignment lips on the triangular sliding collar maintain each of the leg braces in a
30 substantially equal angular relationship, 120 degrees apart, during extension and in the open position.

By maintaining each of the xtension braces within th
ladder at this equal angular relationship and by moving
the ends of the extension braces vertically along the
center post in a coordinated manner, the sliding collar
and center post eliminate binding within the ladder
mechanism. Of equal importance, the braces for each of
the legs, being pivoted at each end are loaded
principally in tension. Alignment channels on the
collar, and matching alignment channels upon each of the
legs, maintain the braces in an equal angular position,
preventing misalignment of the ladder, and maintaining
the entire structure as a rigid well braced tripod,
substantially free from torsion or twisting moments
induced by placing the ladder on an uneven surface, or
induced by the shifting of the weight of the user, which
creates unequal loads on the supporting legs.

It is thus an object of this invention to disclose a
tripod ladder having an improved stability and freedom
from binding.

It is an object of this invention to show an extension
mechanism for a tripod ladder that is substantially free
of binding.

It is a further object of this invention to disclose
an extension mechanism for a tripod ladder which
maintains each of the three extending leg sections in
the strongest possible relationship to the other legs.

It is a further object of this invention to show an
extension mechanism for a tripod ladder which maximizes
the strength and rigidity of the tripod ladder.

It is a further object of this invention to disclose
an xtension mechanism for a tripod ladder which may be

readily manipulated without danger of pinching or catching the operator's fingers in the mechanism during extension and retraction.

5 It is a further object of this invention to centralize and more evenly distribute the weight of the user, and to contain the center of gravity of that weight within the perimeter of the footprint of the stepladder.

10 It is a further object of this invention to disclose a ladder extension mechanism that automatically engages a positive lock in the extended and retracted positions of the ladder.

15 These and other objects of the invention may be more clearly seen from the detailed description of the preferred embodiment which follows.

BRIEF DESCRIPTION OF DRAWINGS

Fig. 1 is a front view with a cutaway showing the tripod ladder in an extended position with the extension mechanism activated.

20 Fig. 2 is a section view of the extension mechanism showing the legs in a closed position.

Fig. 3 is an oblique view of the top cap or upper platform of the ladder.

25 Fig. 4 is a side view section from Fig. 3, showing the attachment of a front leg section to the top cap of the ladder.

Fig. 5 is a bottom view of the top cap or upper platform of the ladder.

30 Fig. 6 is a section from Fig. 5, in view perpendicular to the view of Fig 4, showing the attachment of the front leg section of the ladder.

Fig. 7 is a cross section view vertically downward through the center post and sliding collar of the ladder showing the individual leg braces.

5 Fig. 8 is a view of the control latch of the sliding collar in an engaged locked position.

Fig. 9 is a cross section of the control latch of the sliding collar showing the locking pin retracted during movement.

10 Fig. 10 is a cross section of the control latch of the sliding collar of the invention showing activation of the latch to withdraw the locking pin from engagement.

15 Fig. 11 is a detailed sectional view in two positions showing the mutual engagement of the rear leg braces, the sliding collar, and the rear legs of the ladder showing the captive alignment of the rear leg braces within the alignment channels of the rear legs and the sliding collar.

20 Fig. 12 is a view of the foot of the rear leg of the ladder.

Fig. 13 is a side view of the foot of the rear leg of the ladder.

Fig. 14 is an oblique view of the foot of the front leg of the ladder.

25 Fig. 15 is a side section view of the foot of the front leg of the ladder.

Fig. 16 is a view depicting various cross sections possible for the rear leg sections of the ladder.

30 **BEST MODE FOR CARRYING OUT THE INVENTION**

Referring to Fig. 1, I show in frontal view a tripod ladder 2 of the invention containing th inventiv

extension mechanism 4. The tripod ladder 2 comprises a front leg section 6 and two independent rear leg sections 8, all joined and pivoted from a top cap 10.

5 The front leg section 6, in order to permit climbing, is in the form of two slightly inwardly tapered side rails 12 having individual horizontal steps 14. In the embodiment here described the side rails 12 are in the form of extruded channels within which the steps 14 are
10 mounted and secured, typically by riveting.

The side rails 12 comprising the front leg section 6 terminate in insulated, friction producing feet 16, typically in the form of molded or cast rubber or plastic feet 16 having a high friction and load
15 absorbing capability. The two rear legs 8 likewise terminate in molded or cast rubber or plastic feet, having a frictional base, load absorbing and insulating capabilities. Such feet 16 are shown in Figs. 12-15; in
20 the preferred embodiment of the invention, they have a serrated lower ground gripping face 18 and have upper extensions 20 engaging with the channels 22 of the leg sections 6,8 to securely support the same against impacts and forces of sliding. By enclosing the ends of
25 the leg sections 6,8, the feet 16 also serve as protective padding, to lessen impact damage by the ladder as it is moved about.

Each of the three leg sections 6,8 of the ladder 2 are independently pivoted from the top cap 10. As shown in
30 Fig. 4 the front leg side rails 12 are fastened to the top cap 10 by a pivot pin 24, preferably a rivet, about which the front legs 6 pivot in extension and retraction. A second supporting pin 26 engaged within

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th top cap 10 is free to slide within an arcuate recess 28 within each front leg side rail 12 to permit the front leg 6 to pivot about the first pivot pin 24. The rear legs 8 each are independently fastened between rear leg extensions 30, molded into the top cap 10, by means of a single rear leg pivot (not shown), extending through the rear leg channel 22 and the rear leg extensions 30, and about which the rear legs 8 pivot.

Referring to Figs. 1 and 7, I show the extension mechanism 4 of the invention. A triangular cross section center post 34 is fastened within the top cap 10 of the invention in a center post receiving receptacle 36. This center post 34 extends vertically downward from the top cap 10 and defines the center axis 38 about which the ladder 2 extends and retracts.

The form of the front legs 6 has been described. Each of the rear legs 8 is in the form of a hollow channel or extrusion 22 having high compressive strength and rigidity against bending. From one side of this extrusion 22 extend two parallel lips 40, forming an alignment channel 42. Although these alignment channels are required only for that portion of the leg 8 within which the leg braces 44 may be captive, for additional strength and rigidity of the rear leg 8, alignment channels 42 extend the length of the leg 8.

Journalled around the center post 34 is a triangular sliding collar 46 having three pairs of parallel lips 40 forming three alignment channels 42. The center post 34 defines three sides, 120 degrees apart, forming equal angular faces 48. The alignment channels 42 of the sliding collar 46 extend radially outward from these

thre equal angular faces 48 and define equal angles of support 120 degrees apart. Within each set of alignment channels 42 is pivotally affixed a leg brace 44. The
5 two rear leg braces 44 are extrusions of rectangular cross section pivotally affixed within their respective sliding collar alignment channel 42.

The front leg brace 44a is in the form of two separate angled bars 52. Each angled bar 52 is pivotally
10 affixed to one side rail 12 of the front leg 6 of the ladder 2 at one end; both angled bars 52 are pivotally affixed through a single pivot pin, typically in the form of a closed rivet, through the front alignment channel 42 of the sliding collar 46. The front leg
15 brace 44a angled bars 52 are angled so as to form, in combination with a front leg side rail 12, through a step 14 to a second side rail 12, a triangular bracing structure, the vertex 56 of the triangle being formed through the pivot pin 54 and the two alignment channel
20 lips 40 of the sliding collar 46.

On each of the two front leg brace angled bars 52 is provided an actuating handle 58, a shaped plastic or wooden grip amenable to being grasped by one hand. Within the sliding collar 46, within the front alignment
25 channel 42, is the latching mechanism 60 for locking the position of the ladder 2. The latching mechanism 60 comprises an open sided lock release lever 62, a section of extrusion pivoted within front alignment channel 42 by the front pivot pin 54. Lock release lever 62 holds a
30 ladder extension locking pin 64. An internal spring and washer 66 force the locking pin 64 against the center post 34 of the ladder 2. Periodically, vertically along

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5 th center post 34 of the ladder 2, are provided engagement locking holes 68 within which the locking pin 64 may engage, latching the sliding collar 46 in a fixed position vertically along the center post 34. The head 70 of the latching pin 64 passes through a hole in, and engages with lock release lever 62. Lock release lever 62 is cut away to form an angled lower section 72 so that it may pivot, when depressed, about front pivot pin 54 against the head 70 of the locking pin 64, and has an internal bracing spring 74 maintaining it in an undepressed position.

10 In operation, the sliding collar 46 is moved along the center post 34 by reaching through the steps 14 and gripping one or two of the hand grips 58 on the front leg brace 44a. By lifting up or down on the hand grip 58, the sliding collar 46 may be moved along the center post 34 until the locking pin 64 engages with one of the provided engagement locking holes 68, at which point the locking pin spring 66 forces the locking pin 64 into a hole, latching the sliding collar 46 at a fixed vertical position along the center post 46. One such vertical position is provided as a substantially closed position, the inner ends of the rear leg braces 44 being raised with respect to the outer ends of the rear leg braces 44, drawing the rear legs 8 into the front legs 6 of the ladder 2 and providing a closed ladder form for storage or carriage.

25 A lower engagement locking hole 68 is provided wherein the rear leg and front leg braces 44 approach a horizontal position, being slightly tilted, providing maximum extension of the rear legs 8 with respect to the

front legs 6; this is the principal operable position. Additional engagement locking holes 68 may be provided for intermediate open positions as desired, although the stability of a tripod ladder 2 is based upon the width of the base and therefore maximum extension within a working space is considered most desirable for maximum stability of the ladder 2.

If the locking pin 64 is engaged within an engagement locking hole 68, the ladder 2 may be readily adjusted to another extension by grasping the handle 58, placing a thumb upon the lower portion of the lock release lever 62 and pushing the lock release lever 62 against the resistance of the locking lever bracing spring 74. The lock release lever 62 then pivots against the bottom of the head 70 of the pin 64, pulling the locking pin 64 free of the engagement locking hole 68. Once the locking pin 64 is free, handle 58 movement will move sliding collar 46 past engagement locking hole 68, and lock release lever 62 may be released. The pin 64, although spring biased, rides upon the outer surface of the center post 34 until it engages another engagement locking hole 68, at which point it snaps into engagement, locking the sliding collar 46.

The center post 34 thus acts as a vertical guide or tracking device defining the vertex of planes of extension of the legs 6,8. Each leg 6,8 in turn is braced in a triangular brace comprising the leg meeting at one pivoting vertex in the top cap 10 extending through the top cap 10 down through the center post 34, through the sliding collar 46 to the inner end of the leg brace 44 then through the leg brace 44 to its outer

12.

end pivotally fasten d to th leg 6,8. This support triangle, being formed of members which are pivoted at each end, has all of its members essentially in compression or tension load, with bending moments being much reduced. Thus the legs 8 and leg braces 44 may be made of relatively hollow thin wall extrusions 22 in shapes known to be strong under tension. Alternatively, these members may be formed of composite material in the form of hollow wall regular sections 22 which are strong in tension. Since the ends of the leg braces 44 are pivoted only low bending movements are imposed. The rear legs 8 are supported against bending by the leg braces 44.

The triangle formed by each leg, leg brace and the center post defines a plane of extension. The imaginary plane of extension of the front legs is along a bisector of the angle formed by the two front leg braces meeting at the sliding collar. The construction of the center post and the sliding collar with the sliding collar alignment channels maintains and coordinates each of these planes so that they are equal angular, substantially 120 degrees apart. It is found that if the braces are maintained in coordination by means of the sliding collar and center post and if the planes of extension are maintained at 120 degree equi-angular spacing, then binding does not occur during retraction or extension of the legs. Working loads are more equally distributed over the primary support components of the ladder structure, thereby reducing torsional stresses and enhancing th inherent stability of the structure.

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5 The front leg braces and handles are easily grasped through the front steps of the ladder; the handles are offset, in both the extended and the closed position, from the center post and from the front legs. The danger of pinching of the user's hands during extension and retraction of the ladder is substantially eliminated. In addition, locating the hand grips along the front
10 braces optimally positions the hands so that the user's thumb can readily press upon the actuating lever of the sliding collar lock, releasing the sliding collar from engagement, then letting the sliding collar engage in a second locked position. Thus the ladder may be opened, extended or retracted by an individual standing in front
15 of the front steps, reaching through the opening provided between two adjacent front steps, and free of danger of pinching the hands or fingers in the mechanism as it folds to a closed position or extends to an opened position.

20 Further, by bringing all leg braces as single tension resistant members to a single point of pivoted attachment at the sliding collar substantially all unwanted motion has been eliminated from the tripod ladder and the ladder is resistant to twisting motion or
25 other undesired motion even when the ladder is placed upon an uneven surface.

30 It can thus be seen that the mechanism as described provides for an improved actuating mechanism for a tripod ladder having substantial freedom from unwanted motions even on uneven surfaces, being free from binding during the extension or retraction of the ladder and being substantially free from danger of pinching or

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finger catching during actuation of the ladder 2, and
being able to be actuated from an open to a closed
position and back by an individual standing in front of
the ladder 2 in the normal operating position.

The preferred embodiment has described a preferred
form of the locking mechanism and the channel. It can
be seen that the apparatus may be made of various
materials, and in several detailed forms, all of which
will be apparent to designers skilled in the art. The
form of the extrusions which form the braces and legs
is particularly one admitting a wide variety of forms,
some of which are illustrated in the figures. It should
be apparent that the Claims therefor admit of a wider
variety of equivalents than the specific illustrative
embodiment here described, and the patent is not limited
to that embodiment, but extends to those equivalent
structures claimed.

CLAIMS

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1. An extension mechanism for a ladder of the kind having three independently articulated legs pivoted from a top cap comprising:

10

A central shaft extending vertically down from the top cap;

a collar, slidably journaled on said central shaft;

15

rigid leg braces, pivotally affixed at a first end to said collar, and pivotally affixed at a second end to each leg;

said leg braces of a length that said shaft is at equal angles vertically to each leg.

20

2. The apparatus of Claim 1 further comprising:

means for locking said collar at a position along said shaft.

3. The apparatus of Claim 2 wherein said means of locking further comprises:

25

A lever pivotally affixed to said collar having a depressed and an undeepressed position;

a spring biasing said lever to the undeepressed position;

30

a locking pin suspended on said lever, extending through a provided aperture in the collar and a provided locking hole in the shaft when said lever is undeepressed;

said locking pin being removed from said provided locking hole in the shaft when said lever is depressed.

a spring, biasing said pin into a locking position through said collar against said shaft when said lever is undepressed.

5 4. The apparatus of Claim 1 further comprising:

Means on said collar for maintaining said leg braces at equal radial angles with respect to each other, radially around said shaft.

10 5. The apparatus of Claim 4, said Means on said collar for maintaining said leg braces further comprising:

said collar defining three external faces at equal angles to each other;

an alignment channel extending radially outward from each said face;

15 each said leg brace being pivoted within a said alignment channel.

6. The apparatus of Claim 1 further comprising:

Means on said legs for maintaining said leg braces at a fixed radial angular relationship to said leg.

20 7. The apparatus of Claim 6, said Means on said legs further comprising:

an alignment channel extending radially outward from said leg;

25 said leg brace being pivoted within said alignment channel.

8. The apparatus of Claim 1 further comprising:

Means on said collar for maintaining said leg braces at equal radial angles with respect to each other, radially around said shaft; and

30 means on said legs for maintaining said leg braces at a fixed radial angular relationship to said leg.

9. The apparatus of Claim 1 further comprising:

said collar defining three external faces at equal angles to each other;

5 an alignment channel extending radially outward from each said face;

each said leg brace being pivoted within a said alignment channel.

10 an alignment channel extending radially outward from said leg;

said leg brace being pivoted within said alignment channel.

10. A tripod ladder comprising:

15 three independently articulated legs pivoted from a top cap;

a central shaft extending vertically down from the top cap;

a collar, slidably journaled on said central shaft;

20 rigid leg braces, pivotally affixed at a first end to said collar, and pivotally affixed at a second end to each leg;

said leg braces of a length that said shaft is at equal angles vertically to each leg;

25 means on said collar for maintaining said leg braces at equal radial angles with respect to each other, radially around said shaft;

Means on said legs for maintaining said leg braces at a fixed radial angular relationship to said leg.

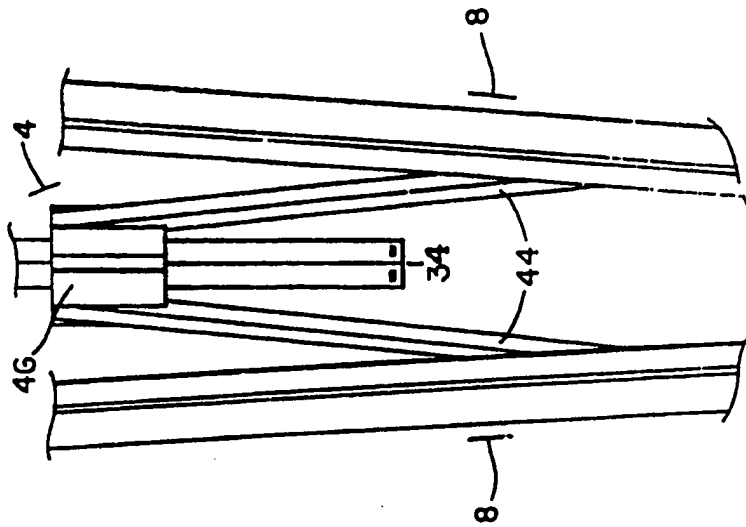


FIG. 2

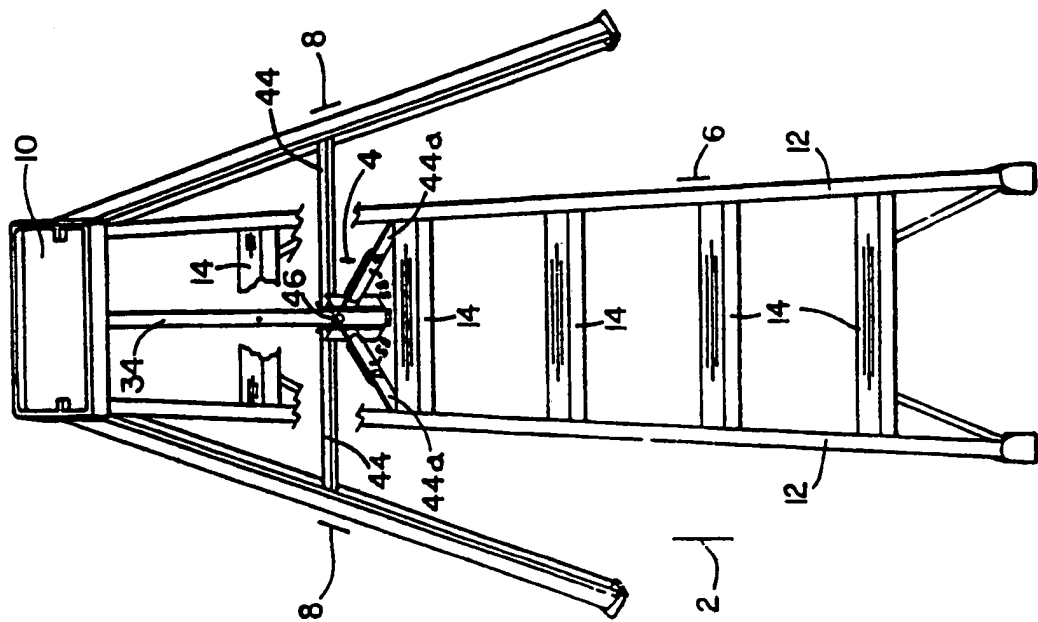


FIG. 1

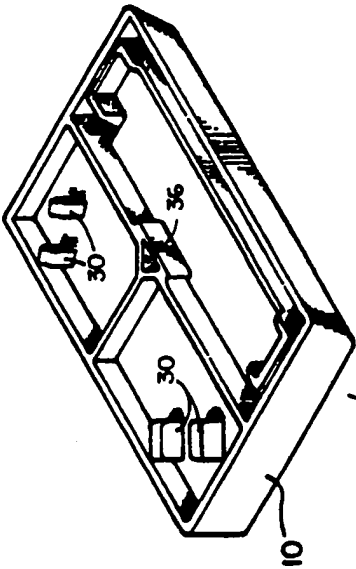


FIG. 5

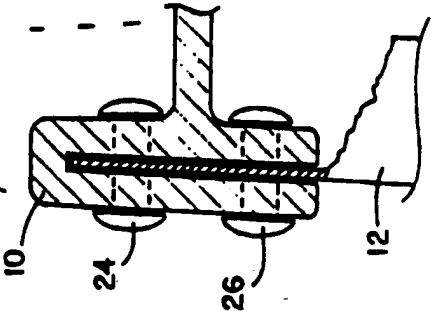


FIG. 6

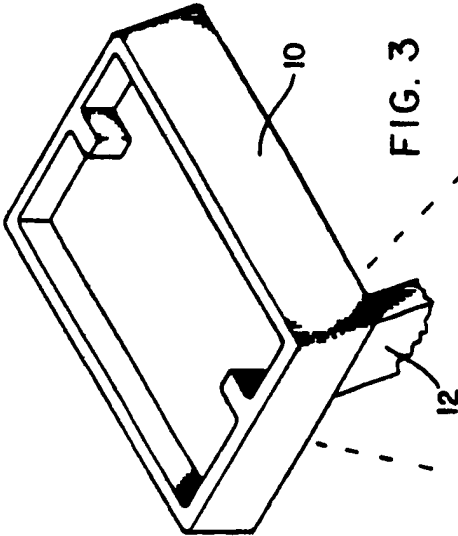


FIG. 3

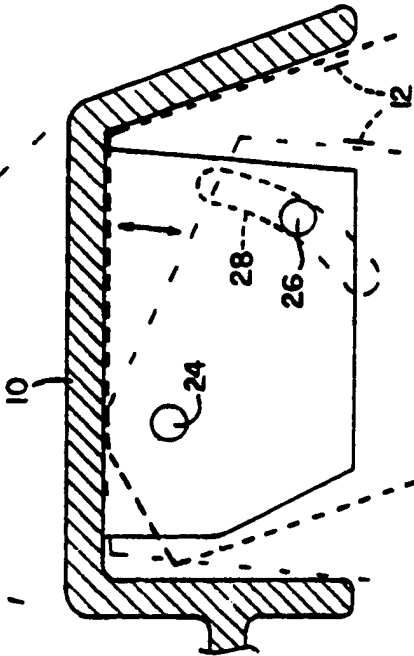


FIG. 4

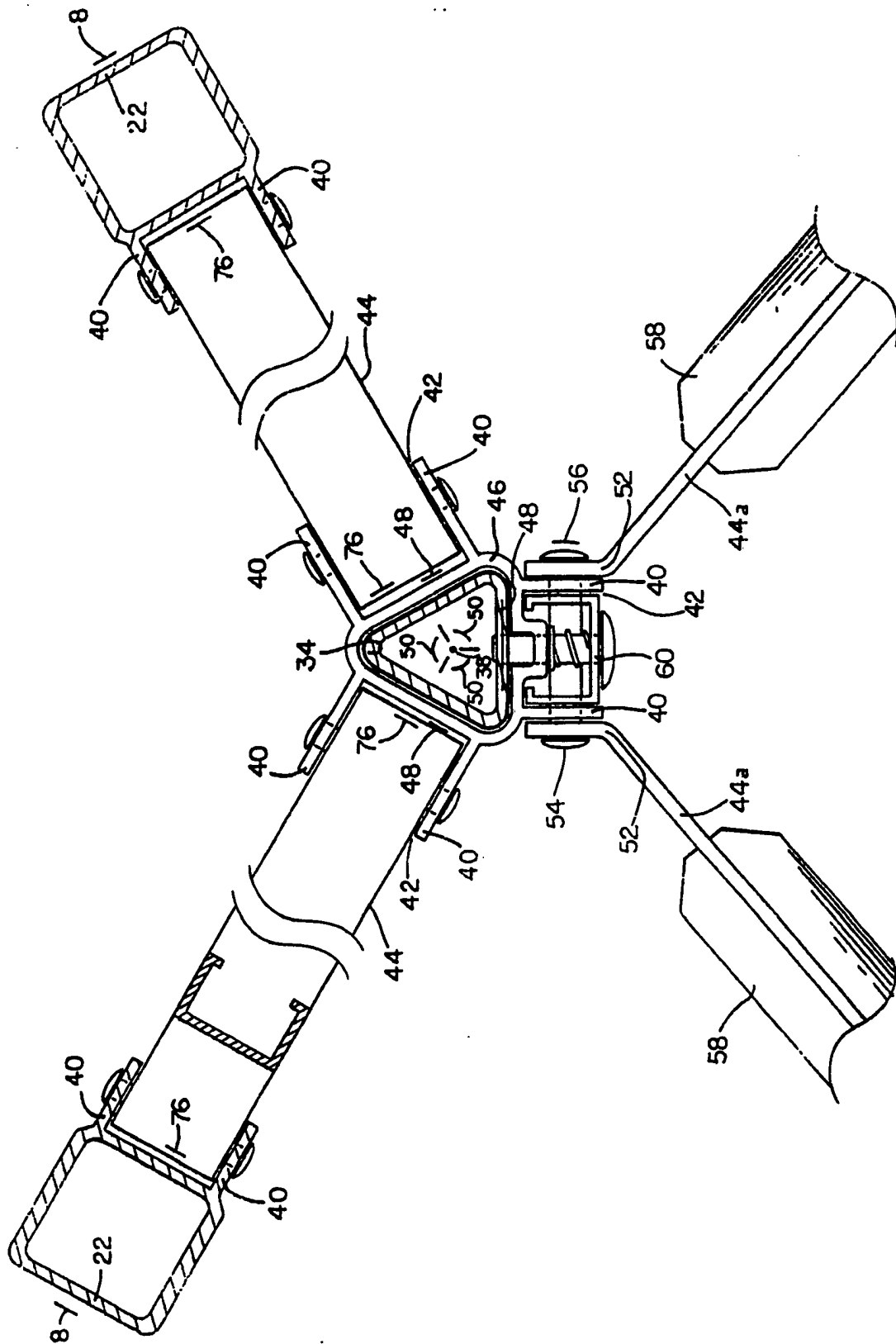


FIG. 7

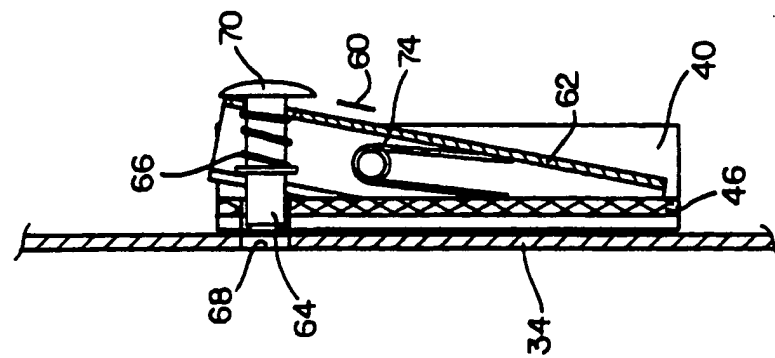


FIG. 10

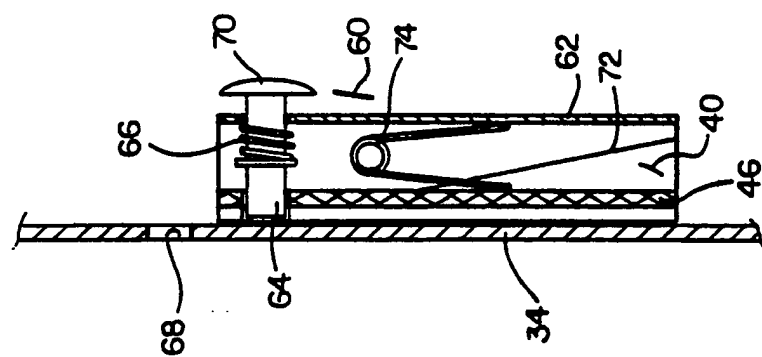


FIG. 9

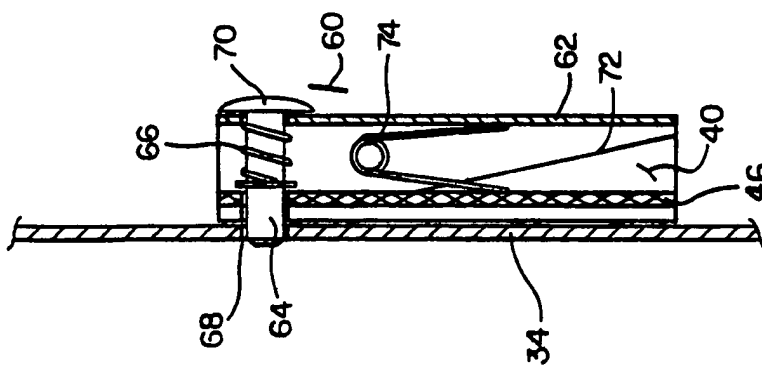


FIG. 8

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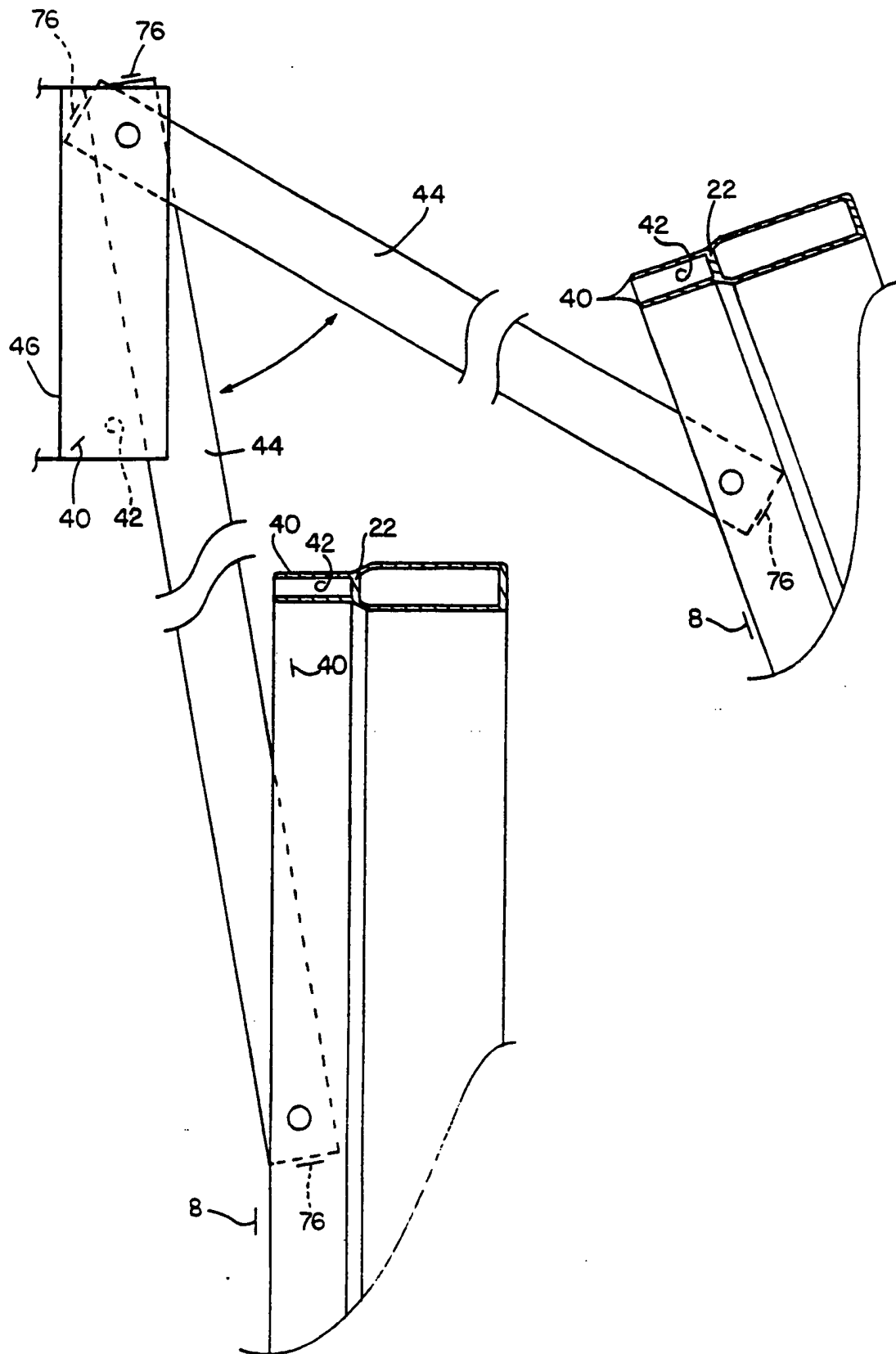


FIG. II

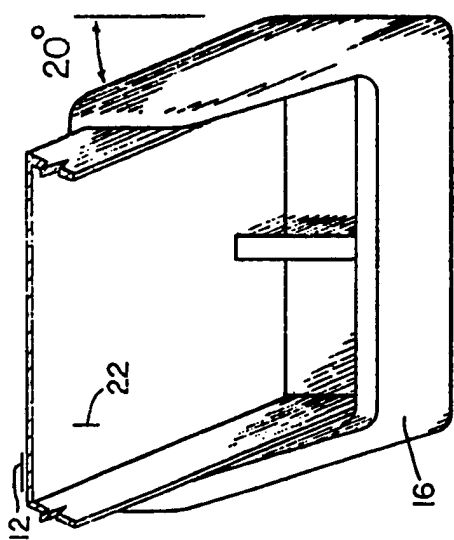


FIG. 14

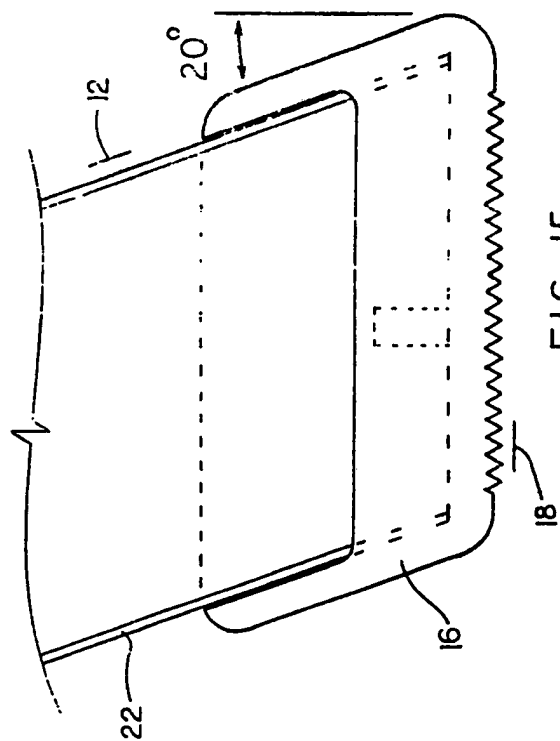


FIG. 15

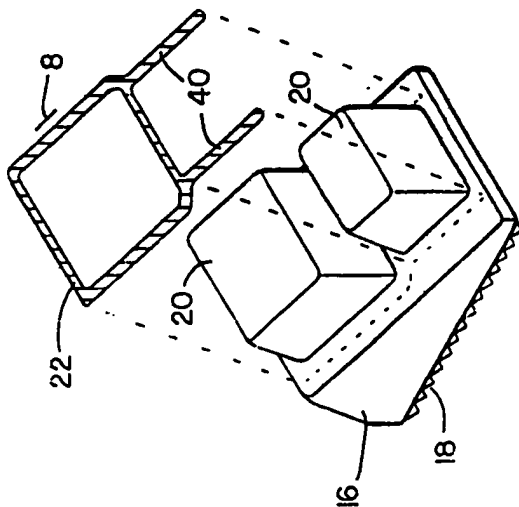


FIG. 12

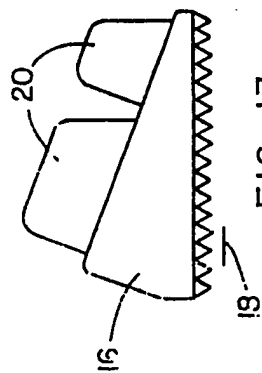


FIG. 13

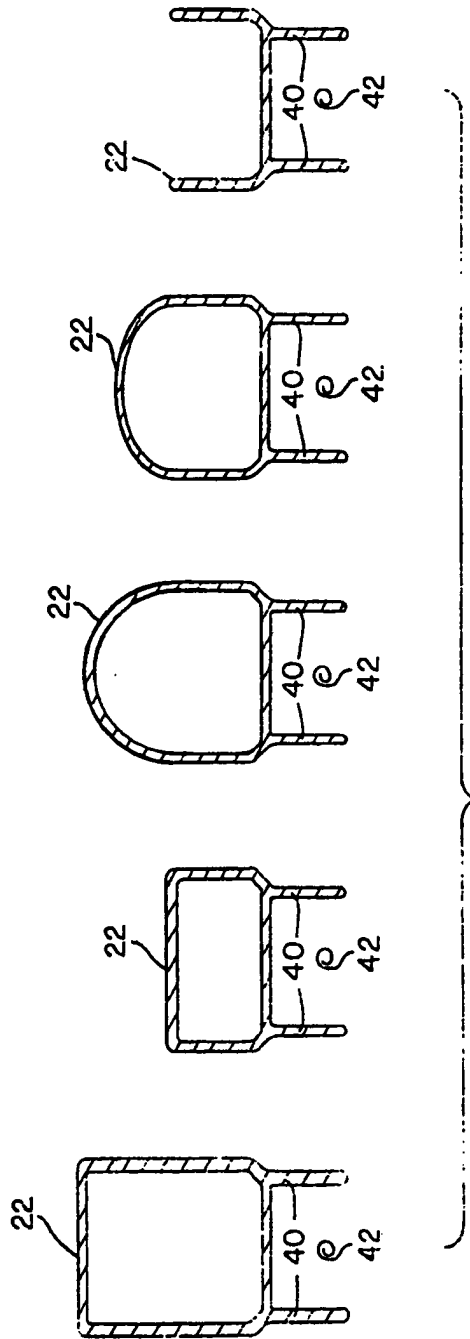


FIG. 16

INTERNATIONAL SEARCH REPORT

International Application No.

PCT/US90/07498

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) ¹ According to International Patent Classification (IPC) or to both National Classification and IPC IPC(5): E04G 1/20 US CL.: 182/170,173,176						
II. FIELDS SEARCHED Minimum Documentation Searched ⁴ <table style="width: 100%; border: none;"> <tr> <td style="width: 50%; border: none;">Classification System</td> <td style="width: 50%; border: none;">Classification Symbols</td> </tr> <tr> <td style="border: none; padding: 10px 5px;">US</td> <td style="border: none; padding: 10px 5px;">182/165,170,173,174,176</td> </tr> </table> Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched ⁵			Classification System	Classification Symbols	US	182/165,170,173,174,176
Classification System	Classification Symbols					
US	182/165,170,173,174,176					
III. DOCUMENTS CONSIDERED TO BE RELEVANT ¹⁴						
Category ⁸	Citation of Document, ¹⁶ with indication, where appropriate, of the relevant passages ¹⁷	Relevant to Claim No. ¹⁵				
A A A A <u>X</u> <u>Y</u>	US, A, 124,518 (SWEET) 12 March 1872 US, A, 947,409 (HUDSON) 25 January 1910 US, A, 1,778,898 (KONIGSBERG) 21 October 1930 US, A, 2,650,014 (HARRISON) 25 August 1953 US, A, 4,754,845 (BAKER) 05 July 1988	<u>1,2,4,5,6,8,10</u> 7,9				
¹⁸ Special categories of cited documents: ¹⁵ "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier document but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art. "Δ" document member of the same patent family						
IV. CERTIFICATION						
Date of the Actual Completion of the International Search ² 19 MARCH 1991	Date of Mailing of this International Search Report ³ 21 MAY 1991					
International Searching Authority ¹ ISA/US	Signature of Authorized Officer ¹⁰ RETINALDO P. MACHADO					